The Treatment of Congenital Talipes Equino-Varus

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Talipes Equino-Varus is the most common orthopædic problem which the newly-born child presents to the doctor or surgeon. It has been estimated that one baby in every thousand is born with some variety of foot deformity. The vast majority of these deformities belong to the type we are at present considering. The analysis, given below, of 118 cases of congenital foot deformities treated at the Ulster Hospital during the past five years, is fairly well in keeping with the figures published from other centres :—

Talipes equino-varus - - - - -	99
Talipes calcaneo valgus - - - - -	14
Talipes equinus - - - - - -	1
Talipes equino-varus on one side associated with calcaneo valgus on the other - - - - -	2
Talipes equino-varus on one side associated with pes planus on the other - - - - -	1
Metatarsus varus - - - - -	1
	118

Thus, out of 118 cases of congenital foot deformities, 102 (or eighty-six per cent.) had either a unilateral or a bilateral equino-varus present.

Importance of the Condition and Necessity for Early Treatment.—The condition is for various reasons an important one. Treatment commenced early in life and properly applied over a long period will end with the complete cure of many cases, and in all great improvement can at least be promised. When treatment is neglected in the early weeks or months of life, or is inadequately carried out, a very unsightly deformity may result. Even the early case may prove very resistent to all methods of treatment, and it may be that years of careful work on the part of the surgeon will in the end result in a moderate or only fairly good foot. How much more then may the neglected case be expected to present a long and difficult problem, painful for the patient, expensive for the parents and for the hospital, and trying and time-consuming for the surgeon.

Nature of the Condition.—Before discussing the treatment of congenital talipes equino-varus, a short reference must be made to some of the more important points concerning the nature of the condition. We shall here consider only those cases in which the deformity has occurred in an otherwise normally developed child. Space would not permit of reference to the treatment of cases of equino-varus associated with other congenital abnormalities, such as spina bifida, congenital absence of the tibia, absence of some of the toes and fingers, or of failure of development of the calf, anterior tibial, and peroneal muscles, etc.

There is some difference of opinion in regard to the part played by the bones, by the muscles and tendons, and by the ligaments and fasciæ, in the production and maintenance of the equino-varus deformity. It is now fairly generally agreed that the cartilages and bones of the foot are primarily normal in shape, and that such deformity as may occur in them is a secondary adaptation to a long continued abnormal position of the foot. Likewise, it is felt that although the everting and dorsiflexing muscles of the foot are elongated and weak, they are not the underlying cause of the trouble and will recover when the position and function of the foot are restored to normal.

ANALYSIS OF THE DEFORMITY.—Whatever the ætiology may be, the deformity can be best understood by considering it as a compound one, made up of a combination of abnormal positions of fixation existing at certain joints of the foot and sometimes at the ankle. Thus the deformity is a combination of :—

(1) Plantar flexion at the ankle-joint. The degree of fixed plantar flexion or equinus at the ankle-joint always appears very much greater than it really is. A careful study of X-ray pictures of talipes equino-varus feet and a comparison of the position of the head of the astragalus before and after correction show that a fairly marked condition of equinus deformity may appear to exist at the ankle-joint on external examination of the foot, when in reality none is present. This will be mentioned further when discussing treatment by tenotomy.

(2) Inversion of the os calcis underneath the astragalus at the sub-astragaloid joint carrying with it the fore-foot. (The hind-foot is the part lying behind the midtarsal joint and made up of the astragalus and os calcis.) In this the foot is rotated inwards around an axis parallel with the long axis of the os calcis, so that the plantar surface of the foot comes to face inwards.

At the midtarsal joint situated at the junction of the fore-foot and the hind-foot—

(3) Plantar flexion
(4) Adduction
(5) Inversion

} of the fore-foot on the hind-foot.

In any individual case of talipes equino-varus, the degree to which any one of these above deformities may be present in combination with the rest varies considerably. One case may have a severe grade of adduction associated with relatively mild grades of inversion and plantar flexion, whilst in other cases the inversion or the equinus may be the predominant element in the compound deformity.

VARIABILITY OF TYPE.—Clinically, it is found, that of two cases, each suffering from a similar degree and type of deformity and commencing treatment at an early age, one may respond readily to manipulative efforts and the other may be extremely resistant to or even impossible to correct by manipulation alone. It may therefore be said that the degree of rigidity present varies from case to case. There have been many theories advanced to explain this varying rigidity. The wide divergence of opinion existing in regard to its causation affords an explanation for the many different types of operation that have been recommended for the rigid foot.

General Principles of Treatment.—Before referring to the various methods of treatment in more detail, it may be well to consider some of the general principles that must be observed if success is to follow our efforts.

It is most important that *treatment should commence as soon after birth as possible.* Delay in commencing treatment carries with it many disadvantages—the necessity for more forcible and more numerous manipulations; more applications of strapping and plaster; more visits of the parents to the hospital; more anæsthetics; more open operations; and in the end a greater proportion of poor or bad results.

The necessity for *over-correction of the deformity* is also of importance. It is not enough simply to correct the deformity: it must be over-corrected if a perfect result is to be obtained. Before being satisfied that over-correction has been sufficiently carried out, one should be able to push the foot into such a position with light pressure of the finger on the sole.

After obtaining satisfactory over-correction, it is important to maintain it until the stretched and weakened muscles on the front and outer side of the leg have regained their power to such an extent that over-correction can be produced by the patient's own unaided efforts. If treatment is stopped before restoration of muscular balance has been obtained, relapse of some degree is certain to follow. Massage and exercises to improve the tone of the weakened muscles after further retention in plaster or strapping is no longer necessary; the provision of boots with strong uppers, the use of a club-foot shoe for a time, and the wedging up of the outer border of the boot, are important adjuncts to treatment while the weakened muscles are gradually recovering their tone.

When restoration of normal position and function have been obtained after a few months' treatment, and the child has not yet reached the walking age, it is important to insist on the *necessity for regular re-examination* until the child has begun to walk and for some months after this. It is not uncommon to see children, who have been declared cured at the age of six to nine months, return after an absence of two or three years with a severe grade of recurrence. These recurrent cases are proverbially difficult to cure. It may be that the trauma of former manipulations has resulted in the production of scar tissue around the joints, and that this now adds to the difficulty of reduction.

Methods of Treatment.—These may be tabulated as follows:—

Correction by means of splints.
Manipulative reduction.
Operations on tendons.
Operations on ligaments and fasciæ.
Bone operations.

Correction by Means of Splints.—Many splints have been devised to secure correction of the deformity, but the majority of orthopædic surgeons are agreed that no splint is entirely satisfactory for the purpose. I have not had any experience of this method, and am not competent to give an opinion regarding it.

MANIPULATIVE REDUCTION.—Repeated manipulations, with retention of the foot, between the treatments, in adhesive strapping, plaster of paris casts, or various splints, is now generally considered the best method of treatment. In the majority of cases in which manipulations are commenced early and properly carried out, complete cure can be obtained. In neglected or late cases manipulative treatment alone can be expected to yield a fair percentage of good results. A certain number of the early cases do not yield to manipulation, and the older the patient and the more severe the deformity the less likely is such treatment to be successful. Nevertheless, manipulative treatment should be tried in every case before proceeding to more drastic measures. It is impossible to say that because a child is nearing adolescence, and has a gross degree of deformity, that correction by manipulation is impossible.

When manipulating a deformed foot, one has two objects in view :—

(*a*) The stretching out of the shortened soft structures on the inner and under surfaces of the foot;

(*b*) The restoration of the bones at the tarsus to their normal relationships to one another at the various joints.

It is desirable to secure these objects, if possible, long before the child begins to walk. During manipulations, considerable force is required, and the aid of a wrench is often necessary. It is important to avoid any strain on the ligaments of the knee by flexing it and having the upper part of the leg grasped firmly by a nurse or assistant. The limb being steadied in this way, the operator grasps the heel firmly with one hand, the thumb or fingers of which act as a buttress to the outer side of the os calcis. With the other hand the adduction of the fore-foot is corrected by stretching out the soft structures on the inner border of the foot. After overcoming the adduction deformity, the foot is now grasped around the back of the heel, over the insertion of the tendo achilles, with one hand, the index finger or the thumb of which supports the back of the external malleolus; with the other hand strong pressure is brought to bear on the inner and under surface of the fore-foot at the level of the metatarsal heads, dorsiflexing, everting, and abducting it. By this manœuvre the structures on the inner border of the foot are further stretched, and at the same time the longitudinal arch is opened out. During these manipulations a twisting strain may fall upon the fibula, and unless the back of the external malleolus is strongly supported a fracture of the fibula may result.

General anæsthesia is often required when much rigidity of the foot exists.

In the equino-varus position, the head of the astragalus forms a marked prominence on the dorsum of the foot in front of and medial to the external malleolus. With over-correction, the interval between the sustentaculum tali and the tuberosity of the scaphoid is increased, and this permits of the head of the astragalus sinking down on the inner border of the foot. Now one finds, instead of the prominence, a distinct hollow in front of the external malleolus, and this is a good index of over-correction. Another reliable index is the appearance of the heel when

viewed from behind. As long as any deformity remains uncorrected, the os calcis will be inverted. Even a slight degree of inversion of this bone is readily noticeable, and if it exists when treatment is discontinued, more or less of the equino-varus deformity will recur (unless a fusion operation on the tarsus has been performed).

Manipulations are usually required once or twice per week for many months. In the intervals between the manipulations it is essential to maintain correction as far as is possible within the limits of safety. Adhesive strapping, plaster of paris, or malleable splints may be used for this purpose. In the majority of cases adhesive strapping is the most effective and most readily applied method, though in some a plaster cast is more suitable. Adhesive strapping may be applied effectively in various ways. Good fixation can be secured by three strips, each from one to two inches wide, according to the size of the foot. The first strip is used to fix the heel and maintain it in eversion. Beginning over the internal malleolus, it passes down from this transversely across the under surface of the heel and, having been made taut, is fixed to the outer side of the leg as far as the knee. The second strip maintains dorsiflexion, eversion, and abduction. It begins on the inner side of the dorsum of the foot at the level of the first metatarsal head, passes slightly obliquely outwards and backwards across the sole, and, being made tight, is fixed obliquely across the back of the calf of the leg. The third strip, beginning over the heel, passes obliquely across the antero-lateral surface of the leg, and fixes the first two strips more firmly in place. Because of the delicacy of the infant's skin, there is a tendency for sores to form on the outer border of the foot under the strapping, and the preliminary application of a piece of lint or adhesive felt is often useful in this position. If the foot is strapped too tightly it is possible to interfere with the circulation of the foot as a whole. One should be satisfied to fix the foot in a position of correction a little less full than that obtained by manipulation.

Operations on Tendons.—Tenotomies have long been practised in the treatment of clubfeet. Tenotomy of the tendo achilles has had in the past a wide popularity. It was hoped that by means of this simple operation correction of the equinus deformity might be obtained. It is common in a severe case of talipes equino-varus for the patient when walking to be unable to put the under surface of the heel any nearer than from one to two inches from the ground. On examination of such a case, it would appear that most of the equinus deformity is present at the ankle-joint, but in reality this is not so. Careful determination of the position of the head of the astragalus, lateral X-ray pictures taken with the foot dorsiflexed as much as possible, and accurate measurements, will show that the equinus deformity is practically always largely due to plantar flexion of the fore-foot on the hind-foot. Tenotomy of the tendo achilles for a condition such as this, by causing a dropping of the heel, will increase the plantar flexion at the midtarsal joint. Further shortening of the already contracted soft structures will result, and increase rather than diminish the difficulty experienced in getting rid of the plantar flexion and inversion present at the midtarsal joint. The number of cases in which tenotomy of the tendo achilles is ever required is very small indeed. As a first step, or indeed anything else than a very last resort in the treatment of congenital talipes equino-

varus, it should be condemned as being usually unnecessary and frequently adding greatly to the difficulty of subsequent correction.

Tenotomy of the tibialis posticus or anticus has not been so commonly practised. Their division may help in some cases. However, such operations are seldom necessary and at best of doubtful value.

TENOTOMY OF THE PLANTAR FASCIA AND MUSCLES as an aid to manipulation is worthy of a trial for the very rigid foot that has failed to respond, before embarking on more drastic operative procedures. It may be helpful when the plantar fascia and muscles are felt to be very taut during an attempt to flatten out the longitudinal arch of the foot.

BONE OPERATIONS.—When the above procedures have failed to correct the deformity, recourse must be had to more radical measures. Numerous operations have been devised and practised for those difficult feet that resist all manipulative efforts. It is not possible here to more than mention some of the most important ones. These radical operations may be classified into three main groups :—

(*a*) *Operations confined to division of shortened soft structures.*

1. Phelps operation : Division of all the soft tissues on the inner border of the foot through a vertical incision just in front of the internal malleolus.
2. Ober's operation : Detachment of the deltoid ligament from the internal malleolus and the sustentaculum tali, and removal of the internal and inferior calcaneo-scaphoid ligaments, with sometimes division of the plantar fascia as well.
3. Brockman's operation : Division of the plantar fascia and separation of all the structures from the under surface of os calcis, together with removal of the internal and inferior calcaneo-scaphoid ligaments.

(*b*) *Operations on bone.*

1. Astragalectomy.
2. Removal of bony wedges from the outer side of the foot.
3. Modifications of Dunn's operation, or arthrodesis of the midtarsal and subastragaloid joints.
4. Osteotomy of the tibia.
5. Division of the external malleolus.

(*c*) *Various combinations of* (*a*) *and* (*b*).

Elmslie's operation : Removal of the anterior two-thirds of the deltoid ligament, the internal part of the astragalo-scaphoid capsule, and also the inferior calcaneo-scaphoid ligament plus osteotomy of the neck of the os calcis and, if necessary, the neck of the astragalus.

In discussing the more radical operations as a whole, it should be pointed out that bone operations should, as far as possible, be avoided. When manipulative measures have failed to correct the deformity, the next step should be subcutaneous tenotomy of the plantar fascia and muscles followed by further manipulation if plantar flexion forms a large part of the deformity. Should success still not be

secured, then more radical operations on the soft structures, such as Brockman's or Ober's, should be given a thorough trial. With these latter procedures correction of the deformity can be obtained in practically all cases. Personally, of these operations, I prefer Brockman's, because I feel that it permits of more thorough division of the contracted structures on the under surface of the sole. Bone operations may sometimes be required in the late or very deformed case. They should be undertaken only when, by manipulation and division of the soft structures on the inner and under surface of the foot, as much correction as possible has been obtained. When a bone operation is necessary, every effort should be made to remove as little bone as possible. The operation of astragalectomy, where a large piece of bone is removed, is almost invariably followed by a relapse of the foot into a more exaggerated position of equino-varus than ever, and the operation should be condemned as a method of treatment for a congenital equino-varus deformity of whatever grade. The dreadfully deformed foot that may and often does follow this operation is almost impossible to improve by any means. It is only after the deformity at the midtarsal joint has been corrected and some equinus deformity is still found to exist, that lengthening of tendo achilles should be performed.

RESULTS OBTAINED AS FOUND BY FOLLOW-UP IN 99 CASES OF CONGENITAL TALIPES EQUINUS-VARUS TREATED AT THE ULSTER HOSPITAL OVER A PERIOD OF FIVE YEARS.

TREATMENT	RESULTS*		
	Bad or Poor	Fair	Good or Perfect
Manipulation alone (56 cases)	31.3%	14%	54.7%
Treatment commenced within a few months of birth	28%	12%	60%
Treatment commenced later, but before walking age	50%		50%
Treatment commenced a varying time after walking began	27%	23%	50%
Tenotomy of tendo achilles early in life, plus manipulation (15 cases)	66%	20%	14%
	(Cases)	(Cases)	(Cases)
Astragalectomy (8 cases)	7	1	0
Wedge removed from outer side of foot (1 case)	0	1	0
Brockman's Operation (12 cases)	2	1	9
Elmslie's Operation (1 case)	0	0	1
Ober's Operation (4 cases)	3	0	1
Knocker's Operation (2 cases)	0	2	0

**Bad Result* - Walking very badly with boots on or off. Unable to run.

Poor Result - Intoeing with boots on, but walking fairly well. Runs badly in bare feet.

Fair Result - Walking well in boots. Fairly obvious deformity, but runs and walks fairly well in bare feet.

Good Result - Practically no deformity. Only intoeing a little when running on bare feet.

Perfect Result - Indistinguishable from normal.